What is claimed is:

[Claim 1] 1. A method of power supply noise and signal coupling analysis for creating a frequency-dependent electrical model related to a microelectronic package, said method comprising the steps of:

extracting geometries from said microelectronic package;

partitioning said geometries into a plurality of cells, said cells having a characteristic size in each dimension of said geometries, wherein said characteristic size is derived from a fastest signal rise time of a signal adapted to propagate within said microelectronic package;

determining a first equivalent circuit for each of said cells; and

for each pair of adjacent cells consisting of a first cell and a second cell, determining a second equivalent circuit for conduction currents between the first cell and the second cell and for electromagnetic coupling between the first cell and the second cell.

[Claim 2] 2. The method of claim 1, further comprising outputting a description of said first and second equivalent circuits configured for use in an electrical circuit simulator.

[Claim 3] 3. The method of claim 2, wherein said cells comprise a rectangular shape having a width and a length, wherein said width and length are each less then 1/20 the size of the wavelength of a knee frequency of the signal.

[Claim 4] 4. The method of claim 1, wherein said step of determining a first equivalent circuit includes the step of assigning a value of resistance, inductance and capacitance of each resistor, inductor, and capacitor, respectively, in said first equivalent circuit.

[Claim 5] 5. The method of claim 1, wherein determining a second equivalent circuit comprises modeling at least one electrical interaction between said first cell and said second cell of said pair of adjacent cells, said at least one electrical interaction being selected from the group consisting of a conduction current interaction, an electric field interaction, a magnetic field interaction, and combinations thereof.

[Claim 6] 6. The method of claim 1, wherein said first equivalent circuit of said cell includes at least one functional component located within said cell, said at least one functional component being selected from the group consisting of a signal via, a power supply via, a signal wire, a conductive plane, and combinations thereof.

[Claim 7] 7. The method of claim 1, wherein said first equivalent circuit of said cell is configured to represent at least one transmission line model having at least one functional component within said cell, said at least one functional component being selected from the group consisting of a signal via, a power supply via, a signal wire, a conductive plane, and combinations thereof.

[Claim 8] 8. The method of claim 1, wherein said first equivalent circuit of said cell is configured to represent at least one inductive coupling model having at least one functional component within said cell, said at least one functional component being selected from the group consisting of a signal via, a power supply via, a signal wire, a conductive plane, and combinations thereof.

[Claim 9] 9. The method of claim 1, wherein said first equivalent circuit of said cell is configured to represent at least one capacitive coupling model having at least one functional component within said cell, said at least one functional component being selected from the group consisting of a signal via, a power supply via, a signal wire, a conductive plane, and combinations thereof.

[Claim 10] 10. The method of claim 1, wherein said first equivalent circuit of said cell is configured to represent at least one resistive model having at least one functional component within said cell, said at least one functional component being selected from the group consisting of a signal via, a power supply via, a signal wire, a conductive plane, and combinations thereof.

[Claim 11] 11. The method of claim 1, wherein determining a first equivalent circuit of said cell comprises modeling at least one electrical interaction within said cell, said at least one electrical interaction being selected from the group consisting of a conduction current interaction, an electric field interaction, a magnetic field interaction, and combinations thereof.

[Claim 12] 12. A method of power supply noise and signal coupling analysis of the electrical interactions between functional components of an electrical system, said electrical system formed in a medium, said method comprising:

categorizing said functional components into at least one functional category;

extracting geometries from said electrical system based on said functional category;

dividing said electrical system into a plurality of cells, wherein each cell has at least one directly neighboring cell, wherein each cell has a length

and a width dimension, said length and width dimension generally being equal to the maximum length and width defined by a fraction of the wavelength corresponding to the knee frequency;

determining whether functional components are present within given ones of said cells;

modeling electrical interactions between functional components within said given cells;

determining which functional components are located in directly neighboring cells;

modeling electrical interactions between functional components located in directly neighboring cells;

calculating equivalent circuits related to the electrical interactions between said functional components within said cells and between directly neighboring cells; and

outputting said equivalent circuits in a format usable by an electrical circuit simulator.

[Claim 13] 13. The method according to claim 12, wherein said fraction of the wavelength corresponding to the knee frequency is one-twentieth.

[Claim 14] 14. The method according to claim 12, wherein said functional categories include at least one category selected from the group consisting of power vias, signal wires, and power planes.

[Claim 15] 15. The method according to claim 12, wherein the step of modeling electrical interactions between functional components within a given cell further comprises:

determining an equivalent circuit composed of lumped elements for the functional components within each of said cells, said equivalent circuit configured to model electromagnetic coupling between functional components located within said cells, wherein said functional components include signal vias, power supply vias, signal wires, and conductive planes.

[Claim 16] 16. The method according to claim 12, wherein the step of modeling electrical interactions between functional components within a given cell further comprises:

determining an equivalent circuit composed of at least one transmission line model, said equivalent circuit configured to model electromagnetic coupling between functional components located within said cells, wherein said functional components include signal vias, power supply vias, signal wires, and conductive planes.

[Claim 17] 17. The method according to claim 12, wherein the step of modeling electrical interactions between functional components located in directly neighboring cells further comprises:

determining an equivalent circuit composed of lumped elements for the functional components within each of said cells, said equivalent circuit configured to model electromagnetic coupling between functional components located within said cells, wherein said functional components include signal vias, power supply vias, signal wires, and conductive planes.

[Claim 18] 18. The method according to claim 12, wherein the step of modeling electrical interactions between functional components located in directly neighboring cells further comprises:

determining an equivalent circuit composed of at least one transmission line model, said equivalent circuit configured to model electromagnetic coupling between functional components located within said cells, wherein said functional components include signal vias, power supply vias, signal wires, and conductive planes.

[Claim 19] 19. An electrical circuit signal coupling analysis system for modeling the electrical interactions between functional components of a microelectronic package, said analysis system comprising:

an electrical system formed in said microelectronic package, said electrical system including a plurality of functional components, wherein said functional components are one of signal vias, power supply vias, signal wires, and conductive planes;

an overall model of the electrical system, wherein said overall model is a representation of the electrical system as a plurality of generally cells having uniform length and width and height dimensions, said length and width dimensions substantially equal to one another and are dependent on a fraction of the fastest signal rise time, said height dimension being dependent on power plane separation in the package, and wherein each cell has at least one directly neighboring cell which is a direct neighbor, wherein directly neighboring cells share a common face therebetween;

a plurality of intra-cell models, each intra-cell model representing the electrical interactions between functional components which are located within a particular cell;

a plurality of inter-cell models, each inter-cell model representing the electrical interactions between functional components which are located within directly neighboring cells; and

extraction means for deriving data corresponding to the electrical interactions which result from the intra-cell models and the inter-cell models.

[Claim 20] 20. The signal coupling analysis system of claim 19, wherein said intra-cell models, and said inter-cell models, each utilize an equivalent circuit composed of lumped elements to model the electromagnetic coupling between functional components which are located within said cells.

[Claim 21] 21. The signal coupling analysis system of claim 19, wherein said intra-cell models and said inter-cell models utilize an equivalent circuit composed of a transmission line model for the electromagnetic coupling between functional components within each of said cells.

[Claim 22] 22. A method of extracting a model, the method comprising:

determining a first dimension derived from a fraction of the wavelength of the knee frequency; and

subdividing a circuit into uniform circuit subdivisions, wherein each circuit subdivision has a length and a width dimension equal to or less than said first dimension;

combining said circuit subdivisions to create said model.

[Claim 23] 23. The method according to claim 22, wherein said fraction is one-twentieth.

[Claim 24] 24. The method according to claim 22, wherein said equivalent circuit subdivisions comprise lumped element circuits.

[Claim 25] 25. The method according to claim 22, wherein said equivalent circuits comprise transmission line circuits.

[Claim 26] 26. The method according to claim 24, further comprising the step of modeling electrical interactions between equivalent circuits within a given circuit subdivision, wherein said equivalent circuit models electromagnetic coupling between functional components located within said circuit subdivision, and wherein said functional components include signal vias, power supply vias, signal wires, and conductive planes.

[Claim 27] 27. The method according to claim 25, further comprising the step of modeling electrical interactions between equivalent circuits within a given circuit subdivision, wherein said equivalent circuit models electromagnetic coupling between functional components located within said circuit subdivision, and wherein said functional components include signal vias, power supply vias, signal wires, and conductive planes.

[Claim 28] 28. The method according to claim 24, further comprising the step of modeling electrical interactions between directly neighboring circuit subdivisions, wherein said equivalent circuit models electromagnetic coupling between functional components located within said circuit subdivision, and wherein said functional components include signal vias, power supply vias, signal wires, and conductive planes.

[Claim 29] 29. The method according to claim 25, further comprising the step of modeling electrical interactions between directly neighboring circuit subdivisions, further comprising the step of modeling electrical interactions between equivalent circuits within a given circuit subdivision, wherein said equivalent circuit models electromagnetic coupling between functional components located within said circuit subdivision, and wherein said functional components include signal vias, power supply vias, signal wires, and conductive planes.

[Claim 30] 30. The method according to claim 22, wherein the step of combining the equivalent circuit subdivisions further comprises the step of assuming that only directly neighboring circuit subdivisions interact.